EVOLVED SEA SPARROW MISSILE (ESSM)

The Evolved Sea Sparrow Missile (ESSM) is a short-range missile intended to provide self-protection for surface ships. On Aegis ships, ESSM will be launched from the MK 41 Vertical Launch System. Four missiles are stored, with tail fins folded, in each launcher cell. Vertical launch requires a thrust vector control system on the ESSM rocket motor. Guidance will be by up-linked commands until the ESSM is near the target, at which time guidance will transition to semi active homing on reflected radar signals from the target. ESSM may also be launched in a home-all-the-way mode (no up-linked commands). At this time, ESSM installation is funded for Aegis ships only. On non-Aegis ships (aircraft carriers, amphibious assault ships, other surface combatants), it will be fired from other launch systems; guidance will be in home-all-the-way to intercept. ESSM uses an 8-inch diameter modified guidance section and a new warhead section. This forebody is attached to a new 10-inch diameter rocket motor, which provides higher thrust for longer duration than predecessor Sea Sparrow missiles. ESSM is a cooperative development effort by thirteen participating governments.

BACKGROUND INFORMATION

Milestone II was conducted in November 1994. During 1998, the program was restructured with an OA based on missile flights at White Sands Missile Range (WSMR), NM, to support the initial LRIP decision. A second LRIP decision was added and will be supported by testing with the Self Defense Test Ship (SDTS). The full production decision will be supported by an OPEVAL, planned for FY03, conducted with an Aegis destroyer. Subsequent to program restructuring, the TEMP was revised and approved by OSD in March 2000. LFT&E component/section level ground testing, conducted in FY96-FY98, included arena tests and fragmentation mat tests against components of U.S. and foreign targets.

TEST & EVALUATION ACTIVITY

FY01 activity included final test flights for the DT at the WSMR, NM. This included the last two guidance test vehicles (GTVs). The GTV results served as the basis for an OA to support an LRIP decision. Tests were conducted in accordance with a DOT&E-approved TEMP and OA plan.

Activity also included two firings for the developmental Aegis S-Band testing at the WSMR, with the third scheduled for November 2001. Additionally, the first two at-sea ESSM firings were conducted in April and September as combined DT/OT on the SDTS. Both the S-band and SDTS tests

were conducted in accordance with a DOT&E-approved TEMP and test plan. The TEMP is being revised in preparation for the OPEVAL.

The Live Fire Test and Evaluation IPT was constituted in FY01, met for the first time in May, and is tasked with producing the Navy's assessment of ESSM lethality to support the full-rate production decision.

TEST & EVALUATION ASSESSMENT

GTV phase (DT supporting OT-IIA): Three GTVs were flight-tested during FY00, and the last two (GTVs 4 and 5) were fired in early FY01. GTV-4 was launched from a vertical launcher at a subsonic, maneuvering target, with successful intercept at medium range and low altitude. GTV-5 was launched from a vertical launcher at a subsonic target, with successful intercept at close-in range and low altitude. Two of the FY00 GTVs experienced loss of radomes during terminal guidance. GTVs 4 and 5 used radomes from a different manufacturer and both radomes survived. These tests demonstrated ESSM capability against various ASCM-like targets while using home-all-the-way guidance.

S-Band Testing (DT supporting OT-IIB): The Aegis S-Band testing is intended to demonstrate missile launch from the MK 41 vertical launching system with mid-course guidance provided by up-linked S-Band commands from a simulated Aegis radar. Terminal guidance is provided by semi active homing. The first two (of three total) missile flight tests were conducted successfully. As of this writing, the final missile flight test is scheduled for early 2002.

Self Defense Test Ship Phase (OT-IIC). The combat system installed on the SDTS is intended to approximate that on non-Aegis ships that use the MK 29 rail launch system. However, the combat system on the SDTS has limitations that constrain ESSM capability against some operationally realistic threats. As a result of better understanding the impact of these limitations, certain missile firing scenarios planned for the SDTS phase are being modified and moved to the OPEVAL with an Aegis destroyer. The TEMP is being updated to reflect these modifications. The first two firings conducted from the SDTS experienced in-flight failures as the missiles evidenced loss of control, caused by failure of the locking pins that are supposed to keep the unfolded tail fins erect. A flight test in late November 2001, using non-folding fins, resulted in the missile executing an inertial midcourse guidance phase, followed by terminal homing on and destruction of the target. Folding fins with redesigned locking pins will be flight tested during the late January 2002 timeframe. Also observed during the initial ESSM firing from the SDTS was severe noise introduction into the signal processor attributed to rear reference signal modulation by the rocket motor exhaust plume. Investigation continues to design an interim fix to mitigate the rocket motor plume noise. Additionally, investigation has been expanded to look for other possible causes of noise introduction into the signal processor.

OPEVAL and FOT&E. Adequacy of the FY03 OPEVAL is dependent upon operational realism of the scenarios. These scenarios are being defined as this is being written. Given the low and dwindling inventories of threat-representative targets (maneuvering supersonic sea-skimmers and supersonic high divers); they may not be available for the OPEVAL; and without them, we would be unable to approve the OPEVAL test plan for adequacy.

For FOT&E, a new anti-ship cruise missile (ASCM) threat has appeared for which there is no credible surrogate target. Given the time required to obtain such a surrogate, this is expected to be an issue for FOT&E. Additionally, limitations in the Aegis Weapon System Baseline 6.3 computer program and shipboard illuminator radars will preclude testing ESSM's capability against surface targets.

Although this is not a requirement, it is a capability provided by predecessor Sea Sparrows on non-Aegis installations.

ESSMs are intended to provide close-in defense of Aegis ships against ASCMs, with Standard Missile providing interceptor capability at longer ranges (both self defense and defense for other ships). There are circumstances where the Aegis Weapon System could be controlling ESSMs and SM-2s simultaneously. This is primarily an Aegis Weapon System (Baseline 6.3) issue that requires operational testing under the DDG-51 program's FOT&E.

LFT&E. The LFT&E strategy is structured around component/section level ground testing, actual missile firing results against ASCMs and surrogates, computer modeling, and simulation analyses. The IPT is finalizing reports of test results. In planning for the collection of lethality data during OT missile firings, the IPT is considering adding low-cost target instrumentation to ESSM flight test targets to record warhead detonation and fragment strikes on target components. The IPT is also currently examining simulation tools and target models that will be used for lethality analyses.

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